Active Project (2015 - 2017)

High Efficiency Direct Methane Solid Oxide Fuel Cell System, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

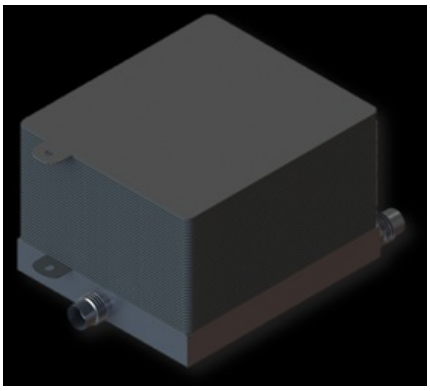
ABSTRACT

NASA has a defined need for energy dense and highly efficient energy storage and power delivery systems for future space missions. Compared to other fuel cell technologies, solid oxide fuel cell (SOFC) based systems are better suited to meeting NASA's efficiency targets while operating directly on methane and oxygen reactants. SOFC power systems for lunar landers and other exploration vehicles are an ideal application for this technology, as well as for power generation on the moon or on Mars. NexTech Materials has established SOFC technology that offers high power density with direct internal fuel reforming and high single-pass fuel utilization, making it uniquely suited for achieving NASA's performance and efficiency requirements. In Phase I of this project, NexTech designed a methane/oxygen SOFC system and established a process model, designed the stack and hot box for this system, and completed testing to validate that the target efficiency of 70 percent was achievable. In Phase II of this project, NexTech will specify and source all system components, build a three-dimensional CAD model of the methane/oxygen SOFC system, build and test 1-kW scale stacks of the Phase I design, demonstrate 70 percent electrical efficiency in a stack with only methane and oxygen reactant feeds, and evaluate long term durability and thermal cycling capability of the stack.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Solid oxide fuel cells have promise to meet some of NASA's emerging power generation system needs. An SOFC power system using the same reactants as the propulsion system (cryogenically stored oxygen and methane) can provide exceptional energy density. Lunar landers or other exploration vehicles are an ideal application of this technology. SOFC systems also may find uses on the moon or on Mars for generating power from



High Efficiency Direct Methane Solid Oxide Fuel Cell System

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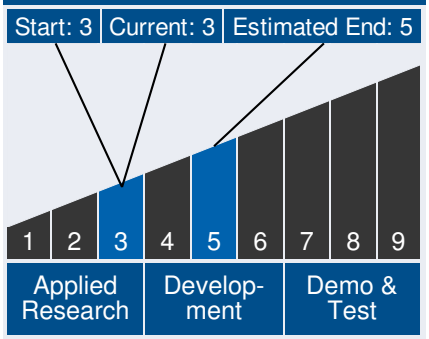
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Continued on following page.

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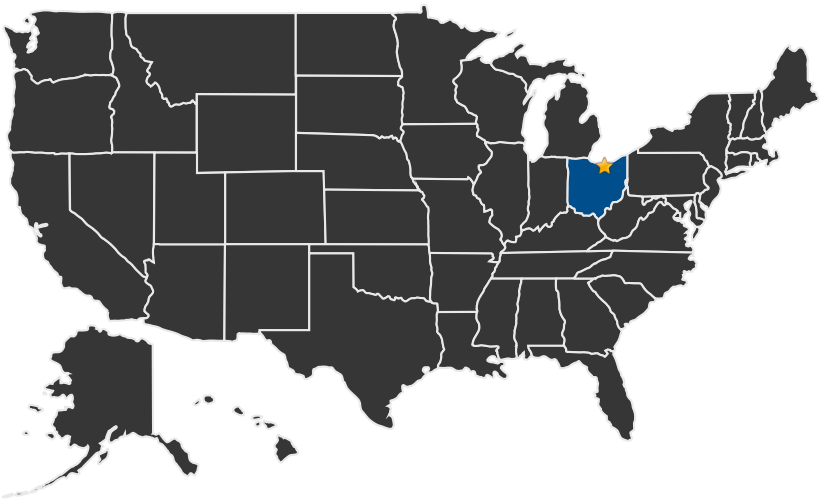
hydrocarbons produced from In-Situ Resource Utilization technologies.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The lightweight and high efficiency SOFC technology to be developed on this project is specifically geared toward meeting the demanding requirements of NASA applications, but will have near-term applicability to energy systems for unmanned underwater vehicles. Meeting the robustness requirements (i.e., thermal cycles and rapid start-up) for NASA applications will make NexTech's SOFC technology suited for other military applications, such as gen-sets, auxiliary power units for silent-watch vehicles, and unmanned aerial vehicles. Additionally, the internal reforming stack technology to be developed in this SBIR project is directly applicable to residential micro-combined heat and power systems.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Management Team *(cont.)*

Program Manager:
- Carlos Torrez

Principal Investigator:
- Scott Swartz

Technology Areas

Primary Technology Area:
Space Power and Energy Storage (TA 3)
└ Power Generation (TA 3.1)
  └ Chemical (TA 3.1.2)
    └ Solid Oxide Fuel Cells (SOFC) (TA 3.1.2.2)

Other Organizations Performing Work:

- NexTech Materials, Ltd. (Lewis Center, OH)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/17971)

DETAILS FOR TECHNOLOGY 1

Technology Title

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